भारतीय मानक
Indian Standard

IS 17729 : 2021

कृषि वस्त्रादि — कृषि और बागवानी अनुप्रयोगों के लिए लचीली जल भंडारण टंकी — विशिष्टि

Agro Textiles — Flexible Water Storage Tank for Agriculture and Horticulture Purposes — Specification

ICS 59.080.99

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Technical Textiles for Agro-tech Sectional Committee, TXD 35

FOREWORD

This Indian Standard was adopted by the Bureau of Indian Standards, after the draft finalized by the Technical Textiles for Agro-tech Sectional Committee had been approved by the Textiles Division Council.

The flexible water storage tank is used to store water in remote areas where the land is undulated and usage of rigid tanks or concrete tanks is not feasible. These tanks can be easily transportable from one place to another after the water being used at one place. The flexible water storage tanks are generally used for storage of rain water, especially in hilly areas for agriculture and horticulture application.

The guidelines for storage and handling of flexible water storage tank are given in Annex J for information only.

The composition of the Committee responsible for the formulation of this standard is given in Annex K.

For the purpose of deciding whether a particular requirement of this standard is complied with the final value, observed or calculated, expressing the result of a test or analysis shall be rounded off in accordance with IS 2 : 1960 'Rules for rounding off numerical values (*revised*)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

Indian Standard

AGRO TEXTILES — FLEXIBLE WATER STORAGE TANK FOR AGRICULTURE AND HORTICULTURE PURPOSES — SPECIFICATION

1 SCOPE

1.1 This standard prescribes constructional particulars and performance requirements for flexible water storage tanks for storage of rain water, especially in hilly areas for agriculture and horticulture purposes.

1.2 These tanks may also be used for storage of water for other domestic and commercial applications except drinking water applications.

2 REFERENCES

The standards listed in Annex A contain provisions, which through reference in this text, constitute provisions of this standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated in Annex A.

3 TYPES

3.1 Based on the capacity, the flexible tanks are categorized into the following 6 types:

Type I — Having minimum capacity of 2 kL;

Type II — Having minimum capacity of 6 kL;

Type III — Having minimum capacity of 12 kL;

Type IV — Having minimum capacity of 25 kL;

Type V — Having minimum capacity of 50 kL; *and*

Type VI — Having minimum capacity of 100 kL

4 MATERIAL

4.1 Polyethylene used for manufacture of inner layer of flexible tank shall conform to the requirements specified in IS 10146. Similarly, Tie, Nylon and EVOH material used in different sub layers of inner layer shall be such that the inner layer conform to requirements specified in Table 2.

4.2 Polypropylene (PP) used for manufacture of tapes used in outer layer of flexible tank shall conform to the requirements specified in IS 10910.

5 MANUFACTURE

5.1 The flexible water storage tank shall be suitably manufactured from the combination of two main layers (Inner and Outer).

5.1.1 *Inner layer* — The inner layer consists of three tubular films, of which each film is a further combination of seven sub layers (PE/Tie/Nylon/Tie/EVOH/Tie/PE) being extruded simultaneously as one film. The resultant thickness of this one film shall be 125 microns, when tested in accordance with method specified in Annex B. The tolerance on nominal thickness at any given point and on the average thickness shall be ± 10 percent. Three such tubular films are further joined in combination together suitably by inserting one tubular film into other to form an inner layer.

These 3 tubular films shall be side sealed by heat sealing process keeping an overlap of at least 13 cm.

5.1.2 *Outer Layer* — The fabric used in the manufacture of outer fabric shall be woven as a tube on circular looms from PP tapes having width of 2.1 mm (tolerance of ± 5 percent) conforming to IS 11197, and linear density of 222 tex (2 000 denier) in warp direction and PP tape of 311 tex (2 800 denier) in weft direction. The mass of the fabric shall be 170 g/m^2 with a tolerance of ± 3 percent, and the ends/dm and picks/dm shall be 48 × 48 with a tolerance of ± 2. The denier of PP tape used in the manufacture of woven fabric shall be subjected to the following tolerances:

a) ± 10 percent on individual value, and

b) ± 5 percent on average.

5.1.2.1 The outer layer shall be black in colour. It shall also be resistant to UV.

5.2 Inner layer shall be inserted into the outer tubular layer and stitching from both the open ends shall be done as specified in **5.3**.

5.3 The stitching shall be done with heracle stitch (*see* IS 10789). The stitching row shall be separated by minimum 65 mm from the outer edge. The stitching shall be done with single fold over seam, so that the stitches pass through a minimum of 8 layers (12 layers for 25 kL and above) of the assembly. The yarn used for stitching shall be UV stabilized twisted fibrillated yarn of minimum 4 500 Denier with a stitch density of 10 to 12 stitches per decimetre. The stitching shall be uniform without any loose thread or knot. The strength of the stitching yarn shall be minimum 200 N, when tested in a tensile tester with a gauge length of 200 mm and rate of separation at 200 ± 10 mm/min.

5.3.1 For tanks having capacity more than or equal to 25 kL, there shall be a resultant conjunction of two outer layers and one inner layer.

5.4 The tank shall be provided with one inlet valve (top) and one outlet valve (bottom). Dimension of the inlet valve (top) and outlet valve (bottom) shall be as per agreement between the buyer and the seller. The type of valves used shall be butterfly valves. The schematic diagram showing the location of valves is given in Fig. 1.

NOTE — The commonly used inlet and outlet valve size is 3 inch.

5.5 A suitable system to address the overflow of the water shall be provided.

5.6 Dimensions

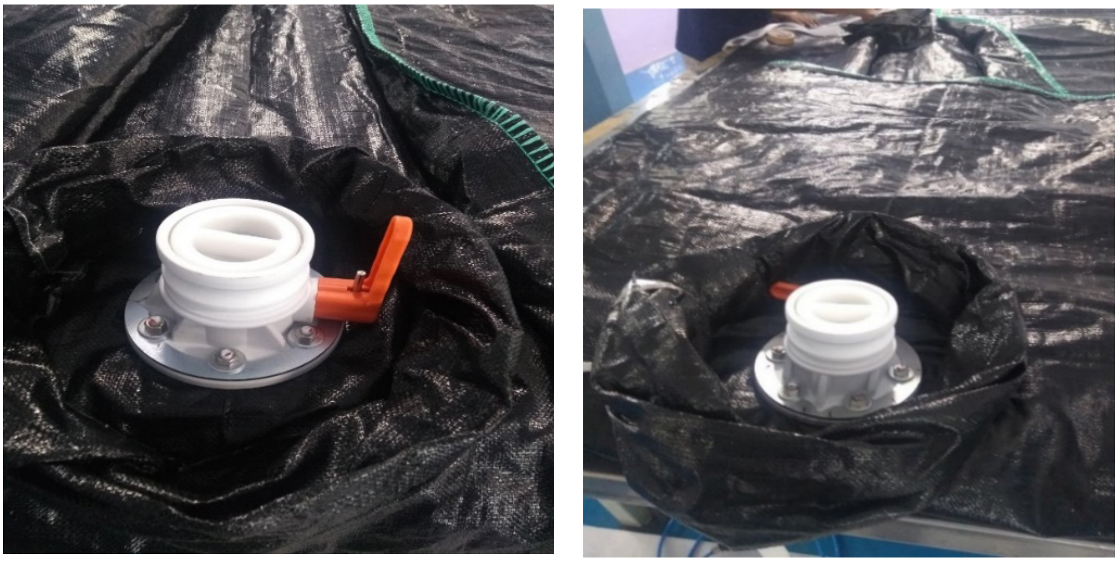
The dimensions of the flexible water storage tank shall be as given in Table 1.

NOTE — The effective dimensions shall be measured from stitch to stitch line for tubular length.

6 REQUIREMENTS

6.1 Each film of inner layer shall conform to the requirements specified in Table 2.

6.2 Outer layer shall conform to the requirements as specified in Table 3.



Butterfly valve at top

Butterfly valve at bottom

FIG. 1 SCHEMATIC DIAGRAM SHOWING THE LOCATION OF THE BUTTERFLY VALVES

Table 1 Dimensions of Flexible Water Storage Tank

(*Clause* 5.6)

Sl No.	**Type**	**Capacity** kL, *Min*	**Tubular Length** mm	**Tubular Width** mm
(1)	(2)	(3)	(4)	(5)
i)	*Type I*	2	3000	1750
i)	*Type II*	6	3000	4000
ii)	*Type III*	12	5000	4000
iii)	*Type IV*	25	7500	4000
iv)	*Type V*	50	15000	4000
v)	*Type VI*	100	32000	4000
Tolerance, cm	–	–	± 2	± 2

6.3 Flexible water storage tank shall conform to the performance requirements as specified in Table 4.

NOTE — Machine direction and cross direction average values shall be on the basis of 5 test specimens in each direction.

7 MARKING

7.1 Each flexible water storage tank shall be legibly marked with the following information by printing on it:

a) Name of the manufacturer or trade mark;
b) Type and capacity (kL) of flexible water storage tank;
c) Tubular length and width, in mm;
d) Batch number or Lot number; and
e) Any other information as required by the buyer or the law in force.

7.2 BIS Certification Marking

The flexible water storage tank(s) conforming to the requirements of this standard may be certified as per the conformity assessment schemes under the provisions of the *Bureau of Indian Standards Act*, 2016 and the Rules and Regulations framed thereunder, and the flexible water storage tank(s) may be marked with the Standard Mark.

8 PACKING

The flexible water storage tank shall be packed as agreed to between the buyer and the seller.

9 SAMPLING

9.1 Lot

All flexible water storage tanks of same type manufactured under similar conditions and delivered to a buyer against one dispatch note shall constitute a lot.

9.2 Unless otherwise agreed to between the buyer and the seller, the number of flexible tanks to be selected at random from a lot shall be as given in column 2 of Table 5.

10 NUMBER OF TEST SPECIMENS AND CRITERIA FOR CONFORMITY

Number of test specimens and criteria for conformity shall be as given in Table 6.

Table 2 Requirements for Inner Layer

(*Clauses* 4.2 *and* 6.1)

Sl No.	Characteristics	Requirements	Method of Test, Ref to
(1)	(2)	(3)	(4)
i)	Tensile strength at break, kg/cm^2, *Min*		IS 13360 (Part 5/Sec 1) and IS 13360 (Part 5/Sec 3)
	a) Machine direction	350	
	b) Transverse direction	350	
ii)	Elongation at break, percent, *Min*		IS 13360 (Part 5/Sec 1) and IS 13360 (Part 5/Sec 3)
	a) Machine direction	650	
	b) Transverse direction	650	
iii)	Ageing test at (70 ± 1) °C for 7 days	Maximum 30 percent reduction of original values of tensile strength	**4** of IS 7016 (Part 8)
iv)	Dart impact strength, g, *Min*	Shall not fail at 1650 g	Method B of IS 13360 (Part 5/Sec 6)
v)	Moisture vapour transmission rate for single inner layer, g/m^2/day, *Max*	2	Annex C
vi)	Oxygen transmission rate, cc/m^2/day, *Max*	1	ISO 15105-2

Table 3 Requirements for Outer Layer made from PP Woven Fabric

(*Clause* 6.2)

Sl No. (1)	Characteristics (2)	Requirements (3)	Method of Test, Ref to (4)
i)	Tensile strength at break, N, *Min*		IS 1969 (Part 1)
	a) Warp	1950	
	b) Weft	1450	
ii)	Elongation at break, percent, *Min*		IS 1969 (Part 1)
	a) Warp	15	
	b) Weft	15	
iii)	Retention of tensile strength after UV exposure of 192 h (Warp and weft direction), N, *Min*	85 percent of original actual value (fabric)	Annex D
iv)	Seam strength, N, *Min*	80 percent of original actual value (fabric), before UV exposure	IS/ISO 13935-1
v)	Seam strength after UV exposure of 192 h (Warp direction), N, *Min*	80 percent of the actual original value	Annex D and IS/ISO 13935-1
vi)	Environmental stress cracking resistance	There shall be no evidence of stress cracking	Annex E
vii)	Cold crack resistance at (–) 20 °C	No specimen shall damage or broken	Annex F

Table 4 Requirements for Flexible Water Storage Tank

(*Clause* 6.3)

Sl No. (1)	Characteristics (2)	Requirements (3)	Method of Test, Ref to (4)
i)	Puncture strength, N, *Min*	300	Annex G
ii)	Ultrasonic leak test	The sample shall not show any leakage	Annex H

Table 5 Scale of Sampling

(*Clause* 9.2)

Lot Size (1)	Sample Size (2)	Sub-sample size (3)	Permissible No. of Defective tanks (4)
Upto 50	3	2	0
51 to 150	5	2	0
151 to 300	8	3	1
301 to 500	13	5	2
501 and above	20	5	3

Table 6 Number of Test Specimens and Criteria for Conformity

(*Clause* 10)

Characteristics	Number of Samples	Criteria for Conformity
Material, Manufacture and dimensions	According to column 2 of Table 5	The defective tanks shall not exceed the corresponding number given in column 4 of Table 5
All other requirements	According to column 3 of Table 5	All the test specimens shall pass the test

ANNEX A

(*Clause* 2)

LIST OF REFERRED INDIAN STANDARDS

IS No./Other publications	*Title*
1969 (Part 1) : 2018	Textiles — Tensile properties of fabrics: Part 1 Determination of maximum force and elongation at maximum force using the strip method (*fourth revision*)
6359 : 1971	Method for conditioning of textiles
7016 (Part 8) : 1975	Methods of test for coated and treated fabrics: Part 8 Accelerated ageing
10146 : 1982	Specification of polyethylene for its safe use in contact to foodstuffs, pharmaceuticals and drinking water
10789 : 2000	Textiles — Stitch types — Classification and terminology
10910 : 1984	Polypropylene and its copolymer for its safe use in contact with foodstuffs, pharmaceuticals and drinking water
11197 : 1985	Specification for monoaxially oriented polypropylene tapes
13360	Plastics — Methods of testing
(Part 5/Sec 1) : 2018	Mechanical properties, Section 1 Determination of tensile properties — General requirements (*first revision*)
(Part 5/Sec 3) : 2018	Mechanical properties, Section 3 Determination of tensile properties — Test conditions for films and sheets (*first revision*)
(Part 5/Sec 6) : 1999	Mechanical properties, Section 6 Determination of impact resistance by the free-falling dart method — Staircase methods
IS/ISO 13935-1 : 2014	Textiles — Seam tensile properties of fabrics and made-up textile articles: Part 1 Determination of maximum force to seam rupture using the strip method (*first revision*)
ISO 15105-2 : 2003	Plastic — Film and sheeting — Determination of gas-transmission rate: Part 2 Equal-pressure method

ANNEX B

(*Clause* 5.1.1)

DETERMINATION OF THICKNESS

B-1 APPARATUS

B-1.1 A dead weight dial micrometer with a flat anvil of 6 mm diameter or larger in area and 4.8 mm diameter flat surface on the head of the spindle or a spring dial micrometer (dial thickness gauge) which has been calibrated against a dead weight dial micrometer shall be used. In case of dispute, only dead weight dial micrometer shall be used and the reading shall be taken between 15 s and 2 min after the load is applied.

B-2 SPECIMENS

Test five specimens, at least 5×5 cm^2 in area, taken uniformly across the width of the test piece.

B-3 PROCEDURE

Dry and clean the surface of the anvil and spindle head, and of the specimen. Place the specimen on the anvil and lower the spindle head on to it slowly. The total load applied by the spindle shall be 110 g. Make one measurement on each specimen approximately at the centre of the specimen. Take mean of the measurements of all the specimens of a sample to obtain the average thickness of the sample.

B-4 ACCURACY

This method is capable of producing measurements with a maximum error of + 0.000 25 cm.

ANNEX C

[*Table* 2, *Sl No.* (v)]

METHOD OF TEST FOR DETERMINATION OF MOISTURE VAPOUR TRANSMISSION RATE

C-1 PRINCIPLE

A test specimen taken from single inner layer is sealed over the open mouth of a test dish which contains water, and the assembly is placed in a controlled environment of 27 ± 2 °C at 65 ± 2 percent relative humidity. Following a period of time to establish an equilibrium of the water vapour pressure gradient across the sample, successive readings of the assembled dish are made and the rate of moisture vapour transmission through the specimen is calculated.

C-2 SAMPLING

The samples shall be selected from different places in the submitted sample so as to be representative of the whole. Minimum of 3 specimens from each sample shall be taken.

C-3 CONDITIONING OF THE SAMPLE

The samples need to be conditioned for minimum of 2 h in relative humidity of 65 ± 2 percent and the temperature of 27 ± 2 °C.

C-4 TEST PROCEDURE

C-4.1 Take care when handling the assembled dishes and avoid splashing the inside surface of the test specimen.

C-4.2 Condition the test sample at least for 2 h in the standard atmosphere for testing

C-4.3 Take three circular specimens each of approximately 9 cm diameter.

C-4.4 Using a burette, transfer the volume of water at 27 ± 2 °C into each open dish predetermined from the dimensions of the dish to give an air layer which is 10 ± 1 mm deep between the surface of the water and the underside of the supported specimens. This requires approximately 46 ml of water in each dish.

C-4.5 Position the triangular sample support in the dish.

C-4.6 Apply a continuous layer of adhesive to the rim of the dish. Position the test specimen such that the face side of the sample is uppermost in the assembly.

C-4.7 Place the cover ring over the rim of the dish, and press firmly down.

C-4.8 Apply a strip of adhesive tape around the full circumference of the assembly sealing the join between the cover ring and the dish.

C-4.9 Place each assembly onto the turntable. Rotate the turntable with the assemblies for a period of 1 h to establish equilibrium of the water vapour transmission for each assembly.

C-4.10 At the end of the equilibrium period carefully weigh each assembly to the nearest 0.001g and record the results.

C-4.11 Record the time these weighings were taken and then replace the dishes on turntable.

C-4.12 Rotate the turntable for a further period of 24 h.

C-4.13 Re-weigh the assemblies to the nearest of 0.001g.

C-5 CALCULATION

5.1 Calculate the moisture vapour transmission rate by the formula as given below:

Moisture vapour transmission rate, g/m^2/day =

$$\frac{24 \times M}{T \times A}$$

where

M = loss in, weight of assembly after 24 h, in g;
T = time, h; and
A = area of the dish, m^2 (0.005 411 3 m^2).

C-5.2 Calculate the average moisture vapour transmission rate of 3 specimen readings.

ANNEX D

[*Table* 3*, Sl No*. (iii) *and* (v)]

UV RESISTANCE TEST

D-1 To determine the effect of UV radiation and weathering on the tensile strength, specimens of outer layer fabric used for manufacturing flexible tanks shall be exposed as given in **D-2** and **D-4**. Similarly, for seam strength, specimens shall be exposed as given in **D-2** and **D-5**.

D-2 TEST CONDITION

D-2.1 The test shall be carried out with fluorescent UV- lamp Type B (313 nm or its equivalent). The duration of the test shall be 192 h (that is, eight days) in continuous mode.

D-2.2 The test cycle shall be: 8 h at 60 ± 3 °C with UV-radiation alternating with 4 h at 50 ± 3 °C with condensation. Irradiance level throughout the test shall be maintained at 0.63 (+ 0.04/-0) W/m^2.

D-3 PREPARATION OF TEST SPECIMENS

D-3.1 Cut 5 test specimens each for testing tensile strength and seam strength from the test pieces.

D-3.2 Specimens shall not contain dirt, irregular spots, creases, holes or other visible faults.

D-4 TEST PROCEDURE FOR RETENTION OF TENSILE STRENGTH

D-4.1 Determine the original average tensile strength of outer layer fabric (both from warp and weft direction) as per the test method specified in IS 1969 (Part 1).

D-4.2 Expose the specimens alternately to ultraviolet light and condensation in respective test cycle in continuous mode for total 192 h.

D-4.2.1 The type of fluorescent UV-lamp, the timing of the UV and condensation exposure and the temperature of the UV exposure and condensation shall be as specified in **D-2**.

D-4.3 Determine the average tensile strength of the outer layer fabric (both from warp and weft direction) separately after UV exposure as mentioned above.

D-4.4 Determine the percent retention of original tensile strength as follows:

Retention of original tensile strength (both from warp and weft direction), percent = $\frac{b}{a} \times 100$

where

a = average tensile strength before UV exposure as obtained in **D-4.1**, and

b = average tensile strength after UV exposure as obtained in **D-4.3**.

D-5 TEST PROCEDURE FOR RETENTION OF SEAM STRENGTH

D-5.1 Determine the original average seam strength of specimens as per the test method specified in IS/ISO 13935-1.

D-5.2 Expose the specimens alternately to ultraviolet light and condensation in respective test cycle in continuous mode for total 192 h.

D-5.2.1 The type of fluorescent UV-lamp, the timing of the UV and condensation exposure and the temperature of the UV exposure and condensation shall be as specified in **D-2**.

D-5.3 Determine the average seam strength of the specimens separately after UV exposure as mentioned above.

D-5.4 Determine the percent retention of original seam strength as follows:

Retention of original seam strength, percent = $\frac{b}{a} \times 100$

where

a = average seam strength before UV exposure as obtained in **D-5.1**, and

b = average seam strength after UV exposure as obtained in **D-5.3**.

NOTES

1 The UV source is an array of fluorescent lamps (with lamp emission concentrated in the UV range).

2 Condensation is produced by exposing the test surface to a heated, saturated mixture of air and water vapors, while the reverse side of the test specimen is exposed to the cooling influence of ambient room air.

ANNEX E

[*Table* 3, *Sl No*. (vi)]

METHOD OF TEST FOR RESISTANCE TO ENVIRONMENTAL STRESS CRACKING

E-1 APPARATUS

An air circulating oven controlled at 60 ± 2 °C.

E-2 TEST LIQUID

A 0.5 percent aqueous solution of polyoxyethylated nonylphenol.

NOTE — Teepol B 300 has been found suitable.

E-3 TEST SPECIMEN

The test specimens shall be cut from the outer layer and shall have a length of 150 ± 3 mm and width of 50 ± 3 mm.

E-4 PROCEDURE

The test specimen shall be dipped in the test liquid contained in a beaker at 27 ± 2 °C. The beaker along with test specimen shall be kept in the oven at 60 ± 2 °C for 48 h. The test specimen shall then be inspected for cracks, the test specimen being sectioned, where necessary.

ANNEX F

[*Table* 3, *Sl No*. (vii)]

METHOD FOR DETERMINATION OF COLD-CRACK RESISTANCE TEST

F-1 PRINCIPLES

Specimens bowed in the shape of a loop are placed in a cooling chamber at –20 °C and subjected to sudden folding under the impact of a free-falling mass of 500 g. The test specimen shall not break or is damaged.

F-2 APPARATUS

The following description is an example of a typical test apparatus design (*see* Fig. 2).

F-2.1 Impact Device, comprising the following elements.

F-2.1.1 *Specimen Holder*, permitting the fastening of one or more specimens on a platen by means of clamps (for example, leaf springs) to clench each specimen along its entire width (15 mm) and to secure 10 mm of each end of the loop (*see* Fig. 2) so that the length of the loop section subjected to folding is 40 mm. The platen may be equipped with a mechanism (revolving type) that allows each specimen to be placed successively in the test position under the guide tube which guides the impact mass.

F-2.1.2 *Rigid Anvil*, connected to, or part of, the specimen holder and on which the specimen is brought into the test position.

F-2.1.3 *Impact Mass*, 500 g, consisting of metal cylinders with a diameter of not less than 18 mm and not more than 29 mm, the edge of the lower face being slightly rounded.

F-2.1.4 *Guide Tube*, to guide the impact mass equipped at the upper end with a mechanism to release the mass (solenoid or mechanical trigger). This tube, approximately 250 mm long and with a diameter 1 mm larger than that of the impact mass, shall be placed vertically above the specimen test position and shall be mounted so that the drop height, that is the distance between the base of the impact mass and the anvil, is 200 ± 2 mm.

F-2.1.5 *Holding Device*, to align the platen and the guide tube in such a position that the centre of the impact mass coincides with the edge of the flattened loop (20 mm from the clamp).

F-2.2 Cooling Chamber, to house the impact device allowing the temperature to be lowered in steps of 1 °C, and able to maintain a temperature constant to within ± 1 °C.

F-2.3 Thermometer, graduated in 0.5 °C, or thermocouple, with an accuracy of 0.5 °C, placed in the cooling chamber in the proximity of the specimens.

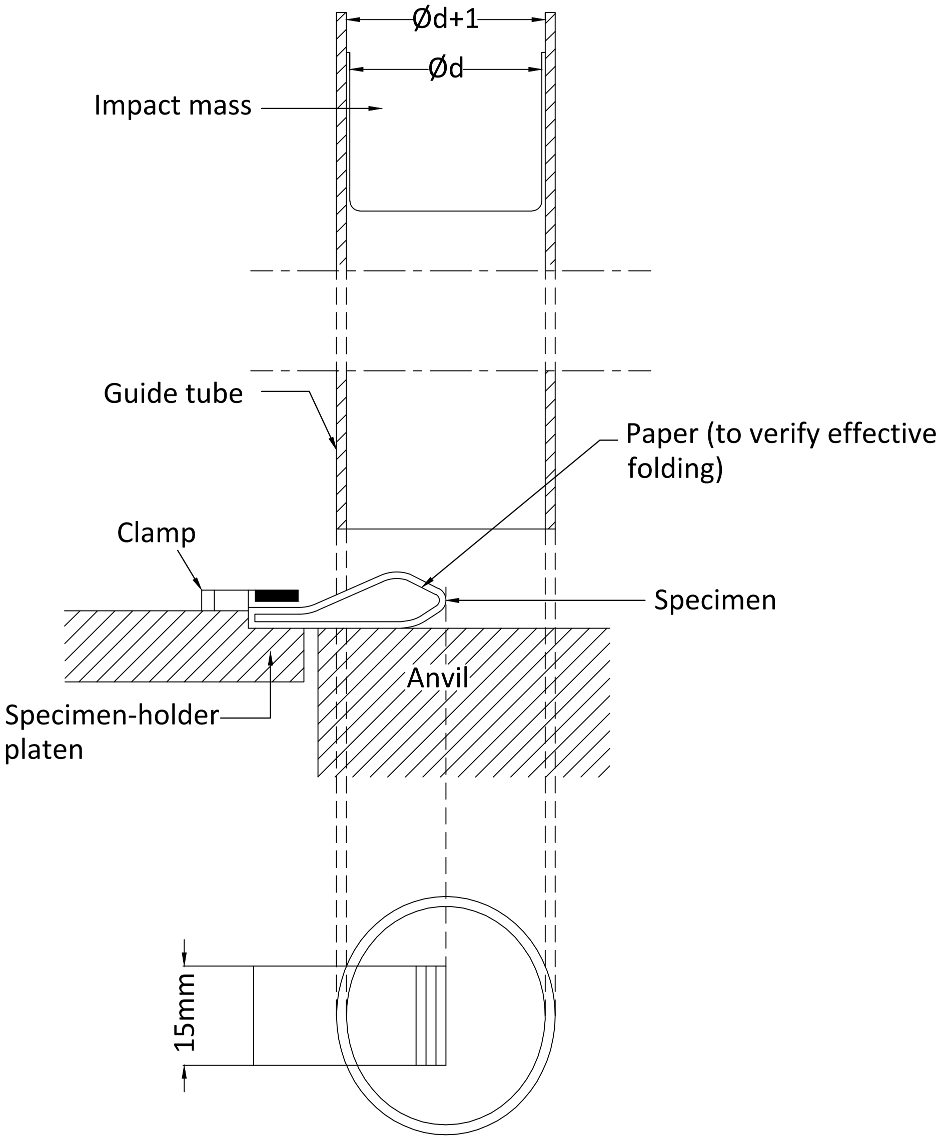


FIG. 2 TYPICAL IMPACT DEVICE FOR DETERMINATION OF COLD CRACK RESISTANCE TEST

F-3 SPECIMENS

F-3.1 Shape and Dimensions

The specimens shall consist of strips measuring 60 mm × 15 mm. Their edges shall be free from cuts, scratches and other imperfections.

F-3.2 Number of Specimens

Five specimens shall be taken with their long axis (60 mm) parallel to the machine (that is, longitudinal) direction, and five specimens with their long axis parallel to the transverse direction.

F-4 ATMOSPHERIC CONDITIONS FOR CONDITIONING AND TESTING

Condition the test specimens to moisture equilibrium from the dry side in the standard atmosphere of 65 ± 2 percent relative humidity and 27 ± 2 °C temperature (*see also* IS 6359). When the specimens have been left in such an atmosphere so that both the faces are exposed to the standard atmosphere as far as possible for 24 h, they shall be deemed to have reached the state of moisture equilibrium.

F-5 PROCEDURE

F-5.1 Verify the alignment of the guide tube with respect to the position of the specimen on the platen.

F-5.2 Place the impact device containing the mounted specimens in the cooling chamber. When the impact device has reached equilibrium at the test temperature of –20 °C (approximately 15 min), position the specimen below the guide tube. Release the impact mass, then reset it to its initial position. Repeat the operation for the other specimens, if any. Take the platen out of the cooling chamber, remove the specimens and inspect them. A specimen is deemed to be damaged or broken, if any trace of breaking is visible to the naked eye. This trace can be a point or a line, while total rupture may occur, with or without splintering. A whitish line at the fold may occur with certain types of pigmented or un-pigmented material, but this is not considered as a failure.

ANNEX G

[*Table* 4, *Sl No*. (i)]

TEST METHOD FOR INDEX PUNCTURE RESISTANCE

G-1 SCOPE

This test method is used to measure the index puncture resistance of flexible water storage tank.

G-2 PRINCIPLE

A test specimen is clamped without tension between circular plates of a ring clamp attachment secured in a tensile testing machine. A force is exerted against the centre of the unsupported portion of the test specimen by a solid steel rod attached to the load indicator until rupture of the specimen occurs. The maximum force recorded is the value of puncture resistance of the specimen.

G-3 APPARATUS

G-3.1 Tensile/Compression Testing Machine, of the constant-rate-of extension (CRE) type.

G-3.2 Ring Clamp Attachment, consisting of concentric plates with an open internal diameter of 45 ± 0.025 mm capable of clamping the test specimen without slippage. A suggested clamping arrangement is shown in Fig. 3. The external diameter is suggested to be 100 ± 0.025 mm. The diameter of the six holes used for securing the ring clamp assembly is suggested to be 8 mm and equally spaced at a radius of 37 mm. The surfaces of these plates can consist of grooves with ‘o’-rings or coarse sandpaper bonded onto opposing surfaces.

G-3.3 Solid Steel Rod, with a diameter of 8 ± 0.01 mm having a flat end with a 45° × 0.8 mm chamfered edge contacting the test specimen’s surface (*see* Fig. 3 and Fig. 4).

G-4 TEST SPECIMEN

The test specimens shall be cut from the flexible water storage tank consisting of both inner and outer layers and shall have a minimum diameter of 100 mm to facilitate clamping. If the 100 mm diameter sample is not available, smaller diameter may be taken provided sample is properly clamped.

G-5 CONDITIONING

Bring the specimens to moisture equilibrium in the atmosphere for testing (65 ± 5 percent relative humidity and 27 ± 2 °C temperature). Equilibrium is considered to have been reached when the increase in the mass of the specimen, in successive weightings made at intervals of not less than 2 h, does not exceed 0.1 percent of the mass of the specimen.

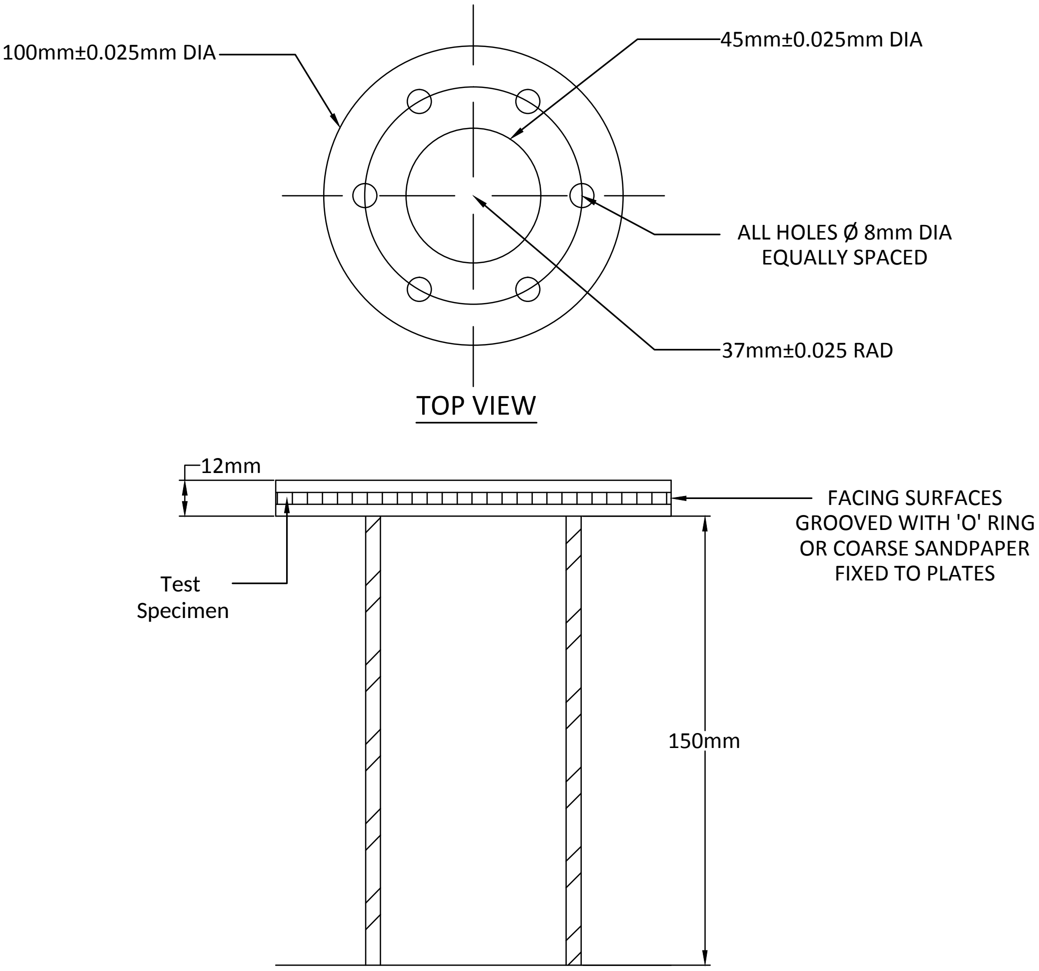


FIG. 3 TEST FIXTURE DETAIL (NOT TO SCALE)

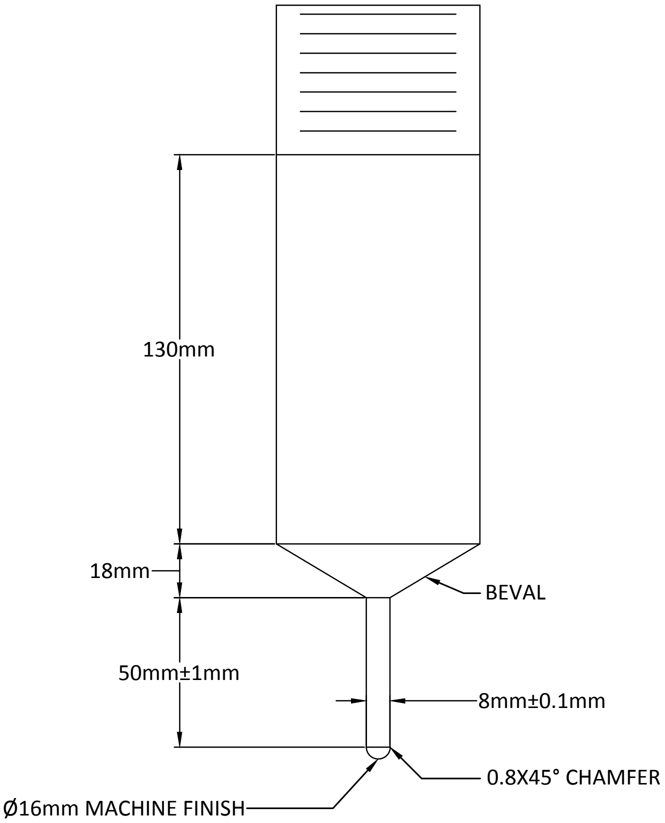


FIG. 4 TEST PROBE DETAIL (NOT TO SCALE)

G-6 PROCEDURE

G-6.1 Select the load range of the tensile/compression testing machine such that the rupture occurs between 10 and 90 percent of the full-scale load.

G-6.2 Centre and secure the specimen between the holding plates ensuring that the test specimen extends to or beyond the outer edges of the clamping plates.

G-6.3 Test at a machine speed of 300 ± 10 mm/min until the puncture rod completely ruptures the test specimen.

NOTE — The rate of testing specified is not an indication of the performance of the specimen for its end use.

G-7 CALCULATION

Calculate the average puncture resistance and standard deviation for all tests as read directly from the recording instrument.

ANNEX H

[*Table* 4, *Sl No*. (ii)]

ULTRASONIC LEAK TEST

H-1 SCOPE

This test method is used to detect the leakage of flexible water storage tank at any point using the ultrasonic leak tester.

H-2 PRINCIPLE

The flexible water storage tank is filled with air at a specified pressure and ultrasonic microphone is moved over to the surface of the tank and sound/frequency for leakage is checked through headphones. This involves an electronic process called heterodyning to convert the high frequency leak sounds to a lower range that allows a hissing leak to be heard through a set of headphones while manually moving the microphone probe to pinpoint the leakage.

H-3 APPARATUS

H-3.1 Ultrasonic Leak Tester, with a set of microphone probe and headphones (*see* Fig. 5).

H-3.2 Air Pump, to maintain the air pressure of 1 kg/cm^2 and to provide clean and moisture free air.

H-4 PROCEDURE

H-4.1 One complete assembly of flexible water storage tank shall be taken up for ultrasonic leak test.

H-4.2 Air pressure of air pump shall be maintained at 1 kg/cm^2.

H-4.3 Now connect the valve of the flexible water storage tank to the air pump.

H-4.4 After the tank is fully filled with air, the air pump shall be disconnected to stop the further entry of air.

H-4.5 Now the flexible tank shall be inspected for leakage test with an ultrasonic leakage test in a silence controlled room.

H-4.6 The microphone probe of the ultrasonic tester shall be moved over all the surface of flexible tank, while the headphones are worn by the inspector to detect the leakage sound.

H-5 REPORT

The sample shall be considered as pass if no leakage sound is detected during the test.

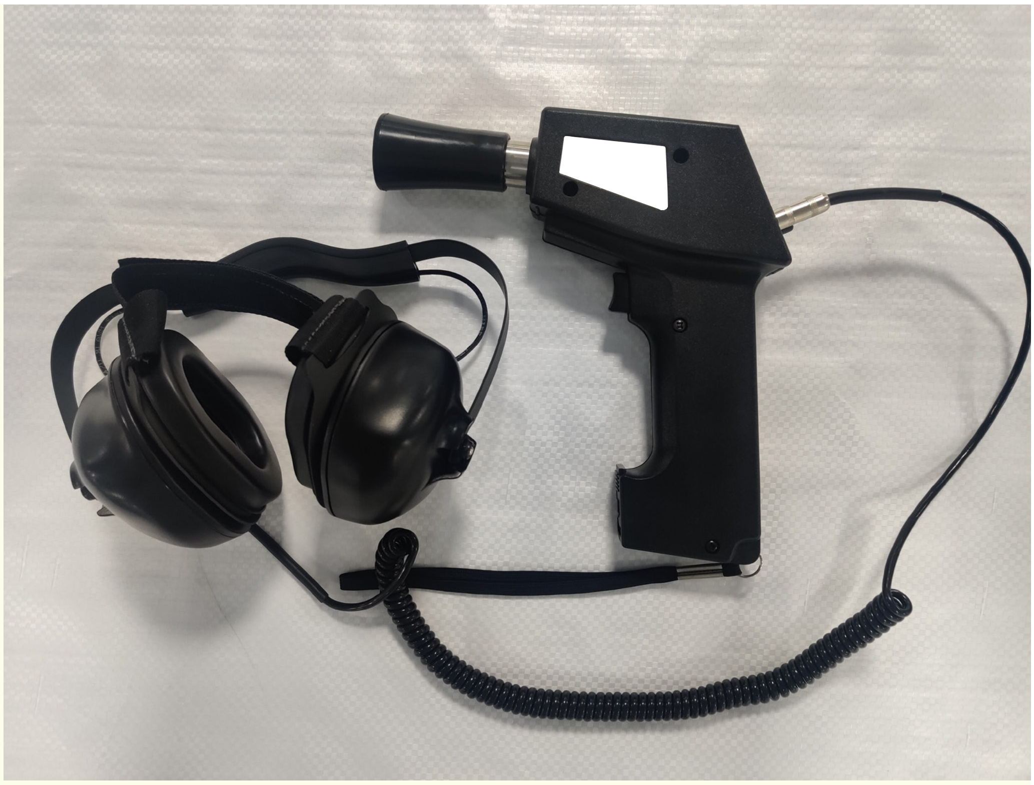


FIG. 5 ULTRASONIC LEAK TESTER

ANNEX J

(*Foreword*)

GUIDELINES FOR STORAGE AND HANDLING OF FLEXIBLE WATER STORAGE TANK

J-1 LOGISTICS

Flexible water storage tanks shall be packed in a carton box. They are light and easy to transport. A small flexible tank, like a 6 kL storage is so light that it can be transported in a two-wheeler. However, while installing, it is imperative that sharp tools like knife and hooks, if required are handled carefully so as not to damage the flexible water storage tank.

J-2 STORAGE AND HANDLING OF FLEXIBLE WATER STORAGE TANK

J-2.1 The flexible water storage tanks shall be stored in clean, dry and levelled surface. These tanks should be always protected from sharp objects. These can be stacked up to 7 tiers.

J-2.2 The flexible water storage tanks should be protected from rodent attack. Following should be ensured to avoid the attack by rodents:

a) Ensure that the surrounding area is free from any food material and clean;

b) Prepare a barrier (a moat for instance) to keep the rodents away;

c) Install rodent baits at strategic locations; and

d) An ultrasonic pest repellent may be installed and a routine checking schedule should be made.

J-3 SITE SELECTION

J-3.1 While selecting the site for installation of flexible water storage tanks, following points should be considered:

a) A surface which is flat and free from sharp rocks is ideal;

b) It is desirable to install it in an open field away from large trees;

c) It is necessary to have the site well away from food or grains storage area; and

d) It is necessary to have the site away from garbage or compost.

J-3.2 INSTALLATION OF WATER STORAGE FLEXITANK

Once the site and the type of flexible water storage tank is finalized, following steps should be followed for installation:

a) Inspect the site for any rough protrusions;

b) Clean and smoothen the surface as best as possible;

c) Before unboxing, check the packed box for any visible damages;

d) Unbox the tank and lay it evenly in the designated area. Ensure the tank is evenly spread out-without any folds or creases

e) If rainwater is a consideration, orient the loading valve towards the rainwater inlet; and

f) It should be ensured that the rain water entry at the inlet valve should be fitted with a filter.

J-4 POST INSTALLATION PRECAUTIONS

The following points should be taken care of after the installation of flexible water storage tank:

J-4.1 If water is going to be pumped from another source, ensure the flow rate never exceeds 800 litres/min.

J-4.2 Flexible water storage tank should be checked for any visible damages on a regular basis.

J-4.3 It is imperative that at no time people should walk on the flexible water storage tank.

J-4.4 When not in use, overflow valve should be kept closed.

J-4.5 Precautions detailed in **J-2.2** should also be considered after installation of flexible water storage tank to protect it from rodent attack.

ANNEX K

(*Foreword*)

COMMITTEE COMPOSITION

Technical Textiles for Agro-Tech Sectional Committee, TXD 35

Organization	*Representative(s)*
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